FIELD-WORK AND NATURE-STUDY
PART III

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MENTAL ATTITUDE IN FIELD-WORK

Just as a sequence of related changes and events makes up the history of the genesis and development of a landscape so, also, it is through a connected series of experiences and associations that the individual mind comes to recognize and understand the content and history of the landscape in its true interrelations and completeness. True progress in nature-knowledge, in science, has been and is accomplished through the struggle of the mind with the unfamiliar materials and changes in nature to know things as they actually are, name, properties, origin, relationships, plus the application, through control and adaptation, of the facts discovered as relating to the needs and conveniences of man whereby he is gradually constructing out of these materials and forces his own social and industrial environment or kingdom. At every step progress has been through personal contact with the actual materials and forces and not through textbooks and lectures. In this growth I am not unmindful of imitation, of the influence of personality, of the power of one person to communicate the facts he discovers, the relationships which he detects, to other persons so that they may avoid going through the same blind hunt until they discover the truths already known. But I am quite sure that the person to whom a fact or discovery has been communicated will understand and assimilate the fact, not in proportion to what he has heard or read about the matter, but in proportion as he has searched for facts in the same manner, or is stimulated to search in some similar manner. Progress in nature-knowledge depends upon the way in which the individual mind meets and deals with the materials and changes in its environment; and the clearness and precision with which another mind grasps discovered facts

and relationships, through any form of communication, depends upon the character of the experience it has had with its nature environment and the manner in which it has dealt with these experiences. Wherever our school work touches sympathetically upon the actual experiences of the children it gains from them a ready response, and interest and activity prevail. If we wish our work to retain this vitality we must organize our courses of study so as to give pupils a broader and richer experience than the interior of our school buildings can ever afford. We must rid ourselves of the idea that we can ever accomplish anything of worth in nature-study by telling children, or by having them read, about things with which they have had little or no personal experience. We must also appreciate the fact that children need a volume of personal-interest experiences before we begin to convert them into conscious knowledge.

Abnormal mental attitudes, induced by our artificial methods in education, are constantly cropping out in our classes and giving us glimpses of the true state of the mind. A few years ago the writer went with a class of students, all of whom were high-school graduates, to a lake shore to study the work of waves. The waves were rolling in leisurely but massively. We could see the pebbles forced shoreward by the in-rush of each wave and dragged back again by the undertow; we could hear the swish and grind of this shore-drift as it was dragged back and forth by the waves. On the beach we picked up pebbles rounded and smoothed, pieces of coal, bits of broken glass, fragments of driftwood, all with the same smoothed and rounded surface as the pebbles. The students spoke of how these various fragments must have had sharp angles and edges when first broken from their main mass, and that their rounded condition must be the result of the friction in their movement by the waves. They inferred that the pebbles must have been angular fragments of rocks worn in the same manner as the coal, glass, and wood and that the sand was to a certain extent the product of the worn-off edges. I considered that we had made the observations and interpretation essential to a clear understanding of the elementary principles of the influence of waves on

shore-drift and that the facts involved had been quite thoroughly assimilated by each member of the class, when one of the students turned to me with the remark: "Now this is all perfectly clear, but how am I to know that it is really true unless I can read of it in some book?" In thinking this matter over it occurred to me that after all the connecting points were really missing; we saw no pebbles actually smoothed, no angles disappear, no sand grains formed—we inferred all. The student saw clearly the isolated facts but could not fit them together to form a chain of relationships. Only those who had pounded and rubbed stones in their childhood could really make the connection; for this our courses of study fail to provide. Fifty rods inland from the lake was a ridge, grass covered, and forested with oak. An excavation in the ridge exposed a mass of rounded pebbles and stratified sand, a duplicate of the materials found on the beach, yet the cause of the presence of that ridge was a mystery to the class. The mind which has not been furnished an adequate supply of sense experiences, nor used its experiences so as to acquire a certain independence of habit and precision in making elementary inferences as to the relations and meaning of observed facts has a poor chance of ever doing any strong work when it has to deal with materials as they exist under natural conditions. Such people will live their life and make use of socialized conditions, but they will never be positive factors in strengthening and maintaining social conditions, for they are without power to socialize the raw materials. If the memorization of knowledge, and the gaining of certain experiences through some routine, were the end, if our fund of nature-knowledge were complete, so that it was merely a thing to be learned and transmitted like the religious myths of ancient tribes, we could teach it in that way; but so long as new truths are being discovered, so long as the landscape changes, and life adapts itself to these changing conditions, so long as the mechanism of civilization is changing, we need to train the mind to deal readily with changing conditions. The mind must be kept plastic, and only a growing mind, a mind which has retained something of the plasticity of its childhood in its power and

habit of going out after, choosing, selecting, arranging, and inferring from its own sense experiences under the impulse of individual interest, desire, need or sense of duty, can remain growing and plastic. It is the limitations set by our well-defined courses of study upon true self-activity which impede growth and progress. We do not attempt to raise plants by furnishing them with just what we think they need; we establish them in rich soil and open air and supplement with such aids as our knowledge and judgment dictates. So with our pupils, we must set them first to live and grow in the richest environment which we can afford; and then minister to their needs as our knowledge and judgment dictate. We are not yet wise enough to assume complete control; we must still have faith that in many places the right response to environment is surer in free nature than under the direction of the teacher; and that the tendency will be for the child to develop and adjust himself rightly if the conditions are right. Wherever there is work to be done the mind needs to be brought into an attitude of original attack on the work at hand. The character, quality, and quantity of work accomplished will be very largely determined by the attitude of the individual toward the work he is attempting and the attitude he maintains while the work is being done. We have all had the experience of seeing classes approach a piece of work with enthusiasm, only to "bog down" before the work was fairly begun. This would not be so bad if we treated the matter as we treat other natural reactions; if we considered the child a normal and natural organism, and sought a scientific explanation for this reaction, instead of assuming that laziness and perversion is a natural attitude to be overcome by some forcing process which is not in keeping with the spirit of science as a practice nor educational in result. Effort and capacity in doing work is very largely a matter of individual purpose or desire, and this depends upon how real or essential the work seems to be to the doer; upon how much of the pupil's real self we are able to enlist in the work. The boy spins his top, picks it up, tosses, catches, and balances it on his string with marvelous precision

and skill, but in spite of our aid his writing remains clumsy and illegible.

The factor which determines the effectiveness of effort in any type of work is that of individual interest, purpose, or motive. Really to determine the working attitude of the mind is to find out the controlling interest or purpose which directs its activities in the main work at hand. There can be no strong action where the purpose is poorly defined and the feeling of a desire to do is absent.

The main individual purpose, in study, of the man engaged in scientific research, the child, and the teacher, differs in its character. In our teaching of nature-study and elementary science we have lost much in effectiveness through our failure to distinguish the character of each purpose and by trying to treat the whole under the purpose of the specialist.

In his study the man engaged in scientific research is ever on the alert for undiscovered forms, facts, and relationships, and his effort is to add something to the fund of human knowledge. He has chosen his special field of work, acquired a comprehensive grasp of its status in terms of present-day knowledge, and mastered the method and technique essential to the furthering of his knowledge in his chosen field. His real preparation for his work came after he had chosen his problem for study or investigation. His originality and resourcefulness as an investigator depend very largely upon the way he worked previous to the period of specialization.

The attitude of the elementary student in nature-study is in character closely allied to that of the special student in respect to dealing with new materials and phenomena and devising means for gaining a proper acquaintance and interpretation of the same, except that he is not facing the region of the unknown to science but the region of the unknown to himself. In attitude as regards their work, in conditions necessary to progress in their work, they are on a par; the main difference is in comprehensive grasp of subject, in accuracy of trained senses and mind, and in mastery of technique essential to progress in the work, and in all this the specialist has the decided advantage. That we

should do honor to the one for his discoveries and deprive the other of the opportunity is to say the least not in keeping with modern reason. It is through this effort to gain individual acquaintanceship and understanding of things for himself that the child acquires that knowledge and power which makes him a valuable member to the race.

The attitude of the teacher in his approach to nature subjects with his class is a very different one. He has already in mind the forms, facts, phenomena, and their interrelations, of his subject, so far as they are known or relevant to the teaching purpose at hand; he has acquired facility in recognizing things at sight and in knowing their relationships or how to set to work to determine their relationships. He brings the materials of his subject and the pupils together, not to see how effectively they may be "crammed" with the facts and relations known to him, but to see how they lay hold of the subject at hand. His attention is not focused upon the discovery of facts in nature new to science but upon facts and relationships new to the children; and his problem is that of bringing about a contact between the materials and phenomena of nature, in the most favorable way, and then to observe the influence of this contact upon mind action and training; to note whether an acquaintance is established, whether new facts and relations are acquired, whether interest is developing, senses becoming more acute, whether these new experiences are being worked out in the mind so that the realities of things are beginning to appear; and withal whether the work is calling out the initiative of the student whereby he is going out after new experiences, observing, experimenting, interpreting, independent of detail directions; whether the pupil is really laying hold of the material at hand, and to withhold his own ready-made theories while the struggle is going on, to render aid wherever and however his judgment dictates, but to avoid, so far as possible, running ahead of the pupil's interests and needs. Situations should arise, out of the child's actual experiences, which enlist his interest and effort in solving or overcoming.

If, after we have done our best in this matter, the results

are not what we expected; if the pupils have not secured the facts and recognized their relationships as we see them and desire that they should; if they do not show the interest and enthusiasm we expected, let us retain something of a scientific attitude of mind in the matter and not place the blame wholly upon the materials with which we have been working, but let us rather look for the cause of failure in our method of treatment. Mind is surely as much a product of evolution, of natural law, as a tree. If the leaves of the tree fail in their work or the roots cease to take up moisture we do not blame the tree but seek for the cause in some abnormal or diseased condition, and having found the cause we render the aid essential to a re-establishment of normal conditions. If the child is not interested in his work, says or does stupid things, does not respond in a normal way to his school environment, no longer shows that eagerness to learn which was so prominent before his school period, let us not place the blame wholly upon the pupil but let us rather, as with the tree, seek the cause in some condition in his environment which is affecting his normal response. It is full time that we begin to believe that there is usually a physical reason for abnormal reactions in children. The entire history of civilization is one ceaseless testimony of the fact "That there is no motive that clings to man as long as the desire for wisdom." That it should be so forced an affair in the schools is to say the least a paradox. That this being, so extremely sensitive and responsive to its environment, so insatiable in its desire and capacity to learn during its first five years, should, when it enters the place organized for the economic continuance of learning, become a plodder, even resist so that we deem punishment, prizes, percentages, essential to an effectual continuance of the process, is a most unnatural condition. "It is vain that we make our children haste to rise early and late take rest and devour many carefully compiled textbooks. If their relations with the laws of nature are harmoniously established from the beginning knowledge will be given to them even while they sleep."

Theoretically no institution or system should respond so readily, or be so plastic in its adjustment to every new discovery

pertaining to economic learning, as the school, but its response is extremely slow. In much of this matter there is need of considerable facing about, especially as to what constitutes real study and as to conditions and methods of stimulating genuine study; as to this matter of enforced or imposed knowledge as opposed to evolved knowledge; and in the matter of the essential mental attitude of students during their periods of study and recitation. We need to acquire ability to recognize genuine interests as contrasted with artificial interests; to know when our pupils enter into their work with the attitude of its being a personal matter, and to know when attitudes insure the accomplishment of a real purpose or work.

If our present-day fund of nature-knowledge and psychology has any one dominant value to the teacher it should be to indicate the proper method of procedure in establishing right relations between the child and his nature environment so that knowledge and power will evolve normally out of this relationship. Much valuable time has been wasted in devising courses of study designed to communicate a certain fund of knowledge, the criterion of selection being whether it was progressing in terms of subject and such as could be learned by the pupil of a given age or grade. What we really need is a course of study selected out of the child's environment, richer in content of subject-matter than any heretofore devised, the criteria of selection being its adaptation in terms of normal reaction to the psychic attitudes and tendencies of a certain age or period. So far as they relate to our nature environment these attitudes may be very generally summarized as—

1. The stage in which the child is interested in gaining a full personal acquaintance with the things around him, in finding out about this new world. In this he is impelled by a devouring curiosity the satisfaction of which is a matter of sense experience. "The cultivation of this instinctive curiosity to see, hear, handle, and secure the maximum number of sensations from any and every object is of most vital importance . . . . this inquisitiveness is naturally the vital factor in later scientific interest." The great need for out-of-door living to secure this

acquaintance and the relation of this experience to sensory training has been too fully dealt with in modern psychology to require reiteration. The truth and its proof is at hand pointing the way whenever we are ready to be guided by it. The essential thing is to spend more time out of doors, to keep in mind the unity of the landscape, to go to places where experiences, of interest to the children and essential to later and more complete interpretation, may be secured. We need to recognize the educational value of playing with pebbles and sand on the lake shore and watching the waves; of gathering flowers; of spying for birds; of wading in brooks; strolling through forests, etc.; to keep in mind that it is sympathetic contact and satisfaction of curiosity through sense experience that the child is after, rather than self-conscious knowledge; and above all to recognize that when the child has satisfied curiosity and his senses, as regards these things, there is no logical reason in his mind why he should pause to contemplate them any longer. "All these physical experiences pass up to the brain and produce some impression there. They do not constitute knowledge . . . . but they do form the unconscious material . . . . which will make his knowledge living and real and not shadowy." This failure to get a rich sense experience in childhood is father to lack of interest, originality, and initiative in youth and later manhood.

A stage slightly in advance of general sensory training is that at which children begin to take interest in connected actions or events apart from themselves, and begin to detect elementary relationships. They attach meaning to the movements of animals, can assume a certain responsibility in the care of domestic animals and pets, can appreciate the songs of birds and interpret their calls in terms of pleasure or alarm, and recognize animals by their tracks and sounds. Our course of study should scan carefully the school environment and incorporate types of experiences of this character into its course of study. Closely related are type experiences of more complex relationships. The gelatinous substance, with its black specks, found in the pond, the wriggling tadpole, and the hopping frog are to the child so many isolated objects. In the aquaria the children may

see these black specks change gradually to tadpoles, and tadpoles to frogs, and these several objects become unified through the chain of observed events. Here again our course of study should scan the school and home environment to see what it offers in the way of similar observational study—the hatching of eggs, metamorphosis of insects, germination of seeds, gullying and erosion of land during heavy rainfalls, etc. The rule should be to have children interested in things doing and in doing things. Discussions, except when children are alive with wonderment and questions generated by these things which they have observed, should be reduced to a minimum. Out of these various experiences, as children grow older, will evolve questions requiring observations controlled by a conscious purpose on the part of the pupil: the cause of change of seasons; what becomes of animals and plants during the winter; factors of control in plant growth; how land surface is molded, etc. The product of this early sense knowledge furnishes the elementary basis and data for this second type of interest which may be termed intellectual interests. This second interest exhibits itself in the form of questions; it generates problems to be solved; it is the how-and-why stage of child-life, the beginning period of purposeful observation and experimentation. It is the stage of the awakening in consciousness of the power to do, to accomplish through individual initiative; and no stage, so far as relates to development of individual power and devotion to duty, needs such careful nurturing. It is the period at which our schools determine for most pupils whether they shall be dynamic powers or human automatons. Under proper guidance there will arise naturally a felt need for controlled investigations which constitutes the pupil's true preparation for the laboratory; and no pupil is really ready for laboratory work who does not carry to it a problem to be investigated. In this matter of interpretation, of detecting relationships, we enter regions where the facts and relationships are obscured by reason of their separation in time or space, or by reason of the fact that they cannot be recorded directly by the senses. It is easy to associate egg, tadpole, and frog when we have once observed the metamorphosis.

It is fairly easy to associate the rounding and smoothing of pebbles with wave action when we pick them up on the lake shore; it is more difficult to make the association when the pebbles are found in a gravel pit several miles inland, and we may fail entirely to interpret a cliff of conglomerate rock in terms of an ancient shore line. These associations depend upon the linking together of a number of elementary observations which will form a connected chain from the shore to the gravel pit and from the gravel pit to the cliff of conglomerate. Our elementary courses need to keep in mind the elementary relationships essential to these broader generalizations and follow and direct the activities of children into regions where they may be secured. The policy of failing to do this and depending on textbook statements to make these connections will always result in that lack of power to think which is at present so prominent in our school work:

> A child brought up with a sufficiently broad basis of this kind is always at home in the world. He stands within the pale. He is acquainted with nature and nature is in a certain sense acquainted with him. Whereas the child brought up . . . . with but little acquaintance with anything but the printed page is always afflicted with a certain remoteness from the actual facts of life, and a certain insecurity of consciousness which makes him a kind of an alien on the earth in which he ought to feel himself perfectly at home.[1]

Schoolwork is not suffering through lack of subject-matter but through failure to utilize to the end of educational effectiveness the common materials near at hand, through failure to recognize the value and educational content of the common things about us. We need to do more to lead pupils to appreciate the fact that the human race, since its beginning, has had nothing but these same common materials of earth, climate, life, and natural forces to study and utilize, and that during the ages these things themselves have undergone but little change. The great change has been in the attitudes of the people themselves, in the things they have found out about these various things, in the way they have used these things to aid them, and in the character and quality of their thinking.

[1] James, *Talks to Teachers.*

At some stage in the work the children should learn something of the history of the origin and growth of certain great conceptions, how great new ideas were evolved, some of the pioneers of new ideas, and how these pioneers and their ideas were received by the public. They should know something of the way in which new ideas had to struggle with old ideas to dislodge them before they could make any headway in the world. We need to develop liberal-mindedness, respect for authority, and above all how to question authority and to distinguish between prejudice and intelligent criticism.

Increase in the pupil's experience should be paralleled by information giving him corresponding increase in breadth of view of the history of the growth of knowledge and its application to progress. The efficiency of elementary field-work, of elementary education as a whole, must be judged in its totality by some standard more comprehensive than that of the successful daily recitation. Its ultimate test must be in the character of its accumulated influence on the individual, both as to right thinking and right action. If field-work had no other value it would be worth while to take pupils out of the schoolroom as a means for testing what we are doing, to develop alertness, individual initiative, and self-control. But because we are all too conscious that we are doing so little, that children are so unmanageable, and that we ourselves can explain nature better and with less fear of contradiction in the schoolroom than we can in the field and wood, or by the lake shore, we avoid the open altogether or use it but half-heartedly at its best, and then try to have it fit our books, rather than having our books fit it.

The essential factor in field-work, as in any type of schoolwork, is a comprehensive definite motive on the part of the instructor and of the school as a unit, in which the from-day-to-day lessons are steps toward this comprehensive end. Information gained through ample sense experience, impelled by strong interests, and directed by definite motives, imparts a quality to the individual quite apart from the facts learned themselves and which remains to mark the efficiency of the individual long after the several facts are forgotten.